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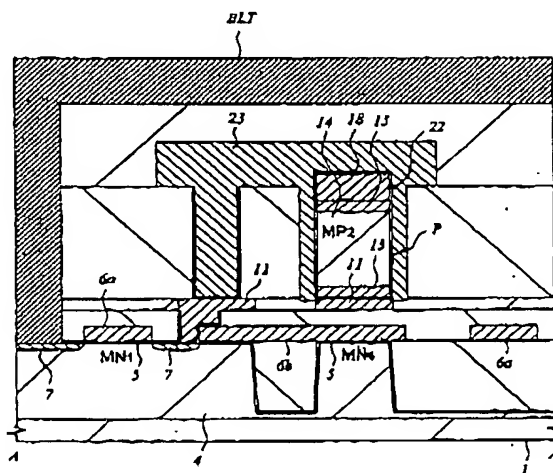
送付公開書類:

— 国際調査報告書

[続葉有]

(54) Title: SEMICONDUCTOR STORAGE AND ITS MANUFACTURING METHOD

(54) 発明の名称: 半導体記憶装置およびその製造方法



(57) Abstract: A memory cell of an SRAM is composed of a transfer MISFET, a drive MISFET, and a load MISFET fabricated over the drive MISFET. The load MISFET has a vertical structure where a gate electrode (23) is disposed over the side face of a multilayer structure (P) extending perpendicularly to a major surface of a semiconductor substrate (1), with a gate insulating film (22) interposed between the gate electrode (23) and the multilayer structure (P). The multilayer structure (P) is composed of polycrystalline silicon films: a lower semiconductor layer (13), an intermediate semiconductor layer (14), and an upper semiconductor layer (15) in order from below.

[続葉有]

WO 03/019663 A1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/05613

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl⁷ H01L27/11, H01L27/108, H01L21/8244, H01L21/8242

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl⁷ H01L27/11, H01L27/108, H01L21/8244, H01L21/8242

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Toroku Jitsuyo Shinan Koho	1994-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Jitsuyo Shinan Toroku Koho	1996-2002

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5198683 A (Motorola, Inc.), 30 March, 1993 (30.03.93), Column 4, line 36 to column 7, line 50 & JP 5-167040 A Column 7, line 11 to column 10, line 23	1-4 5, 6, 9, 10
X Y	JP 9-232447 A (NEC Corp.), 05 September, 1997 (05.09.97), Column 5, line 43 to column 8, line 3 (Family: none)	1-4 5, 6, 9, 10

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "Z" document member of the same patent family

Date of the actual completion of the international search
10 September, 2002 (10.09.02)Date of mailing of the international search report
01 October, 2002 (01.10.02)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/05613

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5670803 A (International Business Machines Corp.), 23 September, 1997 (23.09.97), Full text & JP 8-241931 A Full text & KR 188623 B	17, 18 5, 6, 9, 10
X Y	JP 1-265558 A (Sony Corp.), 23 October, 1989 (23.10.89), Page 2, upper right column, line 12 to page 3, lower right column, line 7 (Family: none)	17, 18 5, 6, 9, 10
A	JP 2001-28443 A (Hitachi, Ltd.), 30 January, 2001 (30.01.01), Column 14, line 50 to column 15, line 33 & WO 00/70683 A	7, 8
Y X A	US 5994735 A (Mitsubishi Denki Kabushiki Kaisha), 30 November, 1999 (30.11.99), Column 38, line 6 to column 41, line 55; column 42, line 36 to column 44, line 28 & US 6127209 A. & JP 7-99311 A Column 57, line 12 to column 62, line 18; column 63, line 11 to column 65, line 30	19, 20, 25, 26 1-6, 23, 24, 27, 28 29, 30
Y A	US 5627390 A (Mitsubishi Denki Kabushiki Kaisha), 06 May, 1997 (06.05.97), Column 14, line 8 to column 15, line 29; Fig. 16 & JP 7-321228 A & DE 4443968 A & DE 4447639 A & US 5780888 A & US 6150688 A & KR 200222 B	19, 20 29, 30
Y	JP 6-104405 A (Toshiba Corp.), 15 April, 1994 (15.04.94), Claims 1, 2 (Family: none)	25, 26
A	Shigeyoshi WATANABE et al., A Novel Circuit Technology with Surrounding Gate Transistors (SGT's) for Ultra High Density DREAM's. IEEE Journal of Solid- State Circuits, Vol.30, No.9, 1995.09, pages 960 to 971, full text	1-30

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/05613

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The inventions of claim 1-18, 21-30 relate to an SRAM.
The inventions of 19, 20 relate to an SRAM.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/10510

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)
This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

☐ Claims Nos.:

because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

As is described on the extra sheet, in order to satisfy the requirement of unity of invention, a special technical feature is required to link the inventions disclosed in the claims as to form a single general inventive concept. However, the present international application includes six groups of inventions: claims 1, 2, 4-13, claim 3, claims 14, 15, claims 16, 22-32, claims 17-21, 33-50, and claims 51-64.

(Continued to extra sheet)

1. ☒ As all required additional search fees were timely paid by the applicant, this International search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☒ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/10510

Continuation of Box No. II of continuation of first sheet (1)

Document 1: JP 63-29571 A (Hitachi Ltd.), 1988.02.08
Document 2: US 5821579 A (LG Semicon C., Ltd.), 1998.10.13
Document 3: US 5670803 A (International Business Machines Corporation), 1997.09.23

The technical feature common to claims 1 to 64 is configuration of "having a gate electrode formed on a side wall of the channel forming region via the gate insulation film".

However, the search has revealed that the configuration of "having a gate electrode formed on a side wall of the channel forming region via the gate insulation film" is not novel since it is disclosed in all the drawings of Document 1, Figures 2 to 4 of Document 2, and all the drawings of Document 3.

As a result the configuration of "having a gate electrode formed on a side wall of the channel forming region via the gate insulation film" makes no contribution over the prior art and cannot be a special technical feature within the meaning of PCT Rule 13.2, second sentence.

Consequently, there is no technical feature common to all the claims.

Since there exists no other common feature which can be considered as a special technical feature within the meaning of PCT Rule 13.2, second sentence, no technical relationship within the meaning of PCT Rule 13 between the different inventions can be seen.

Therefore, it is obvious that claims 1 to 64 do not satisfy the requirement of unity of invention.

(1) The independent claims 1, 2, 4, 5 have a special technical feature common to them that "a thermal treatment step" is performed after formation of an intermediate semiconductor layer in the longitudinal MISFET manufacturing method.

(2) The independent claim 3 relates to a longitudinal MISFET manufacturing method but has no special technical feature since the method is disclosed in the aforementioned Documents 1 to 3.

(3) The independent claim 14 has a special technical feature that in the longitudinal MISFET "the impurities concentration inserted into the intermediate semiconductor layer is low in the region nearer to the lower semiconductor layer and the upper semiconductor layer and high in the region far from the lower semiconductor layer and the upper semiconductor layer".

(4) The independent claim 16 relates to a semiconductor storage device manufacturing method but has no special technical feature since the method is disclosed in the aforementioned Documents 1 to 3.

(5) The independent claims 17, 18, 19, 20, and 21 have a special technical feature common to them that "a thermal treatment step" is performed after formation of the channel formation region in the semiconductor storage device manufacturing method.

(6) The independent claims 51, 63, 64 relate to a semiconductor storage device but has no special technical feature since the device is disclosed in the aforementioned Documents 1 to 3.

Consequently, the present international application includes six inventions.